

Sept. 19, 1933.

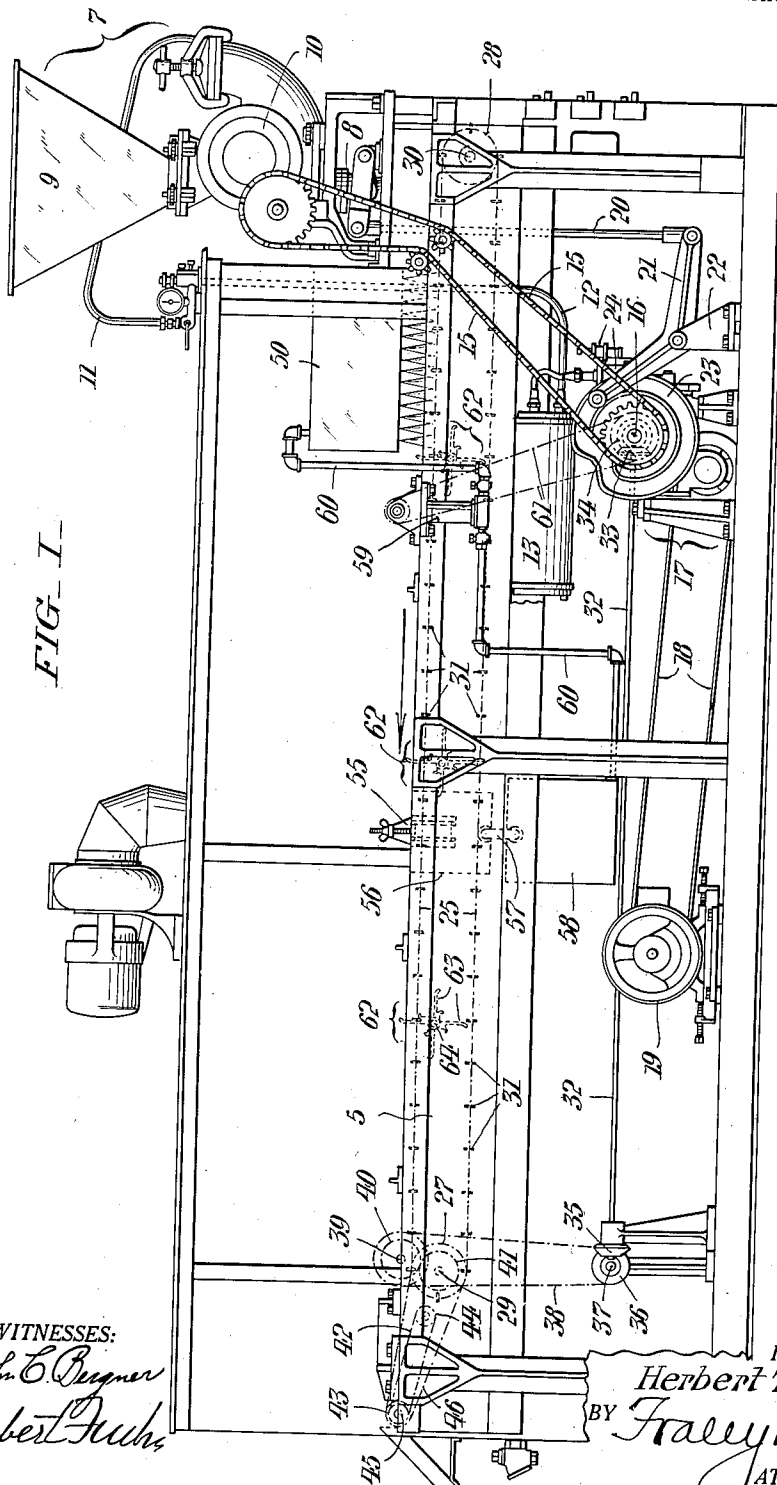
H. T. HUNTER

1,927,786

METHOD OF AND APPARATUS FOR COOKING DOUGHNUTS AND THE LIKE

Filed Jan. 13, 1932

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

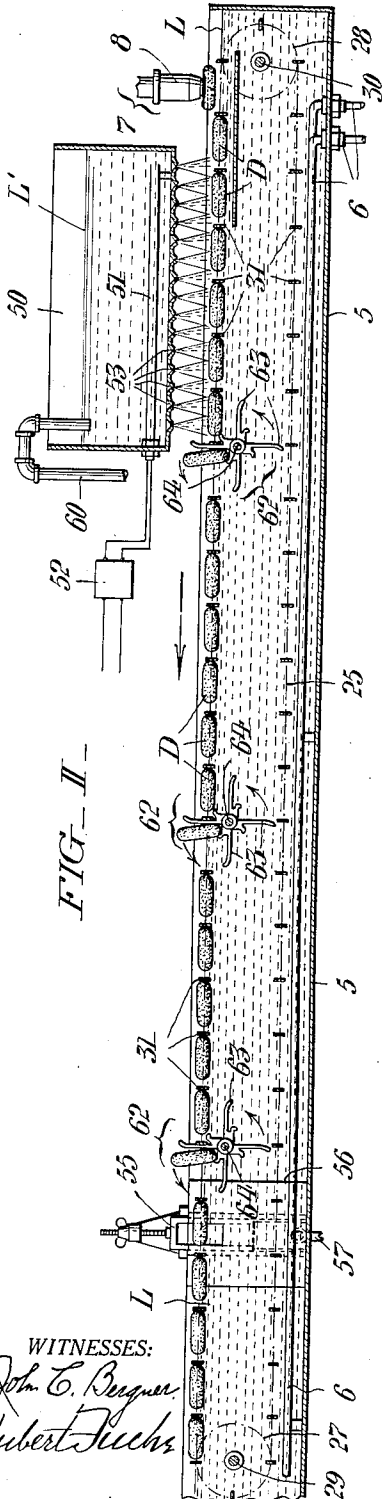
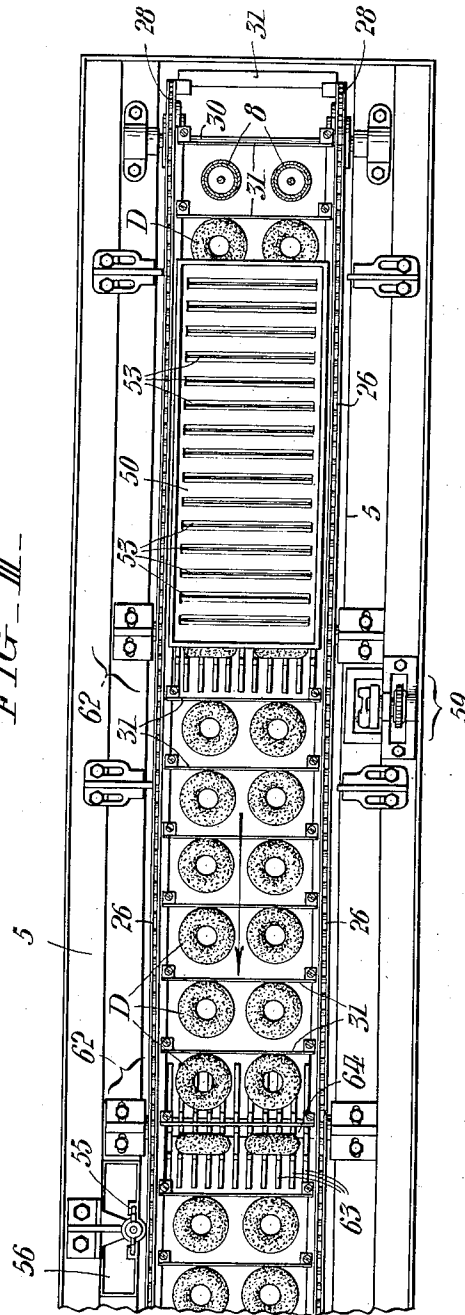


FIG. II

FIG. III



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UNITED STATES PATENT OFFICE

1,927,786

METHOD OF AND APPARATUS FOR COOK-
ING DOUGHNUTS AND THE LIKEHerbert T. Hunter, Baltimore, Md., assignor to
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Application January 13, 1932. Serial No. 586,312

15 Claims. (Cl. 53—7)

This invention is concerned with the cooking of doughnuts, and like food products in hot liquor, and also with apparatus useful in this art.

In cooking doughnuts in automatic apparatus of the flotation type such as exemplified in U. S. Patent No. 1,823,146, granted to me on September 15, 1931, annular formations of raw dough are released by a forming means, to drop horizontally into hot cooking liquor contained in an elongate tank in which they are first progressed, afloat on one side in the liquor, to a turnover located about midway of the length of the tank. After being turned over, the doughnuts are further progressed afloat on their opposite sides, to the delivery end of the receptacle and there ejected from the apparatus. Upon being dropped into the tank, the raw annular formations sink in the cooking liquor, and, after submergence for a few seconds, rise to the surface under the buoyant action of gases generated in them. After rising, and during the first half of the cooking period, the doughnuts give off moisture mostly through their upper or exposed sides which are thereby ruptured; while their lower sides undergo full expansion as a consequence of immersion in the cooking liquor, and take on a smooth crust. Due to exposure during the initial half of the cooking period, the upper sides of the doughnuts receive but a small amount of heat by comparison, and the expansion of these exposed sides is delayed until after the doughnuts are turned over. After turning, the doughnuts continue to give off moisture through the sides then uppermost; but this action is necessarily restrained by virtue of the heavy and substantially impervious crust which was formed on the said sides during the first half of the cooking period. As a consequence of such checking of moisture release, there are formed internally of the doughnuts nearer the sides which are in contact with the cooking liquor during the second half of the cooking period, substantially solid unexpanded annular cores which render the doughnuts heavy, and, to a corresponding degree, indigestible. In addition to the objectionable solid cores just mentioned, the doughnuts cooked under the aforescribed conditions have a rough broken side of light color, and a smooth side of darker color which is usually flat.

Broadly speaking, my invention is directed toward overcoming the above recited drawbacks of previous practice in the art of cooking doughnuts, that is to say: I aim to make it possible to produce doughnuts which are evenly expanded and thoroughly cooked throughout and therefore

light in texture; which are characterized by smoothness and even browning of their surfaces; and which are moreover uniformly regular in size and configuration. This desiderata I attain as hereinafter fully explained, by spraying the doughnuts for a time with hot cooking liquor from above during the early stages of the cooking period and while afloat on one side, and thereafter periodically turning them over for flotation on their opposite sides, with attendant immersion in the cooking liquor and exposure for equal intervals of time for the remainder of the cooking operation.

My present invention is further directed toward provisions in connection with cooking apparatus embodying means for conveying the doughnuts in the cooking liquor, for spraying the doughnuts during the early stages of the cooking, and for turning them over periodically incident to progression in the apparatus as required under my improved method.

Still further objects and attendant advantages of this invention will be manifest from the detailed description following in connection with the attached drawings, wherein Fig. I shows a side elevation of a doughnut cooking apparatus suitable to the practice of my new method of cooking.

Fig. II is a partial longitudinal sectional view of the apparatus drawn to a somewhat larger scale; and

Fig. III is a partial plan view of the apparatus.

The apparatus herein illustrated comprises an elongate horizontal receptacle 5 containing hot cooking liquor L which is maintained at a temperature of approximately 400° F. by a submerged electric heating coil conventionally indicated at 6 in Fig. II.

Pairs of raw annular formations are successively released, side by side, to drop horizontally into the cooking liquor in the receptacle 5, by a forming device which is generally designated by the numeral 7, in Fig. I and which is mounted at one end of said receptacle, the forming dies of the device being indicated at 8. This forming device 7 is preferably of the construction shown in a patent application, Serial No. 501,784 filed by me on December 12, 1930, in which the dough from the hopper 9 is fed, by means of an interposed rotor 10 and with the assistance of compressed air supplied through a tube 11 and pipe 12 from a storage tank 13, to the forming dies 8. The rotor 10 of the forming device 7 is continuously rotated through motion communicated by a sprocket chain 15 from the shaft

16 of a speed reduction mechanism 17 located within the frame of the apparatus beneath the cooking receptacle 5. The speed reducing mechanism 17 is in turn driven by a belt connection 18 from an electric motor 19, also located within the frame of the apparatus below the cooking receptacle 5. The forming dies of the device 7 are actuated, through the medium of a link connection 20 and a bell crank 21 fulcrumed to a fixed bracket 22 on the frame of the apparatus, by a rotary side groove cam 23 affixed to the shaft 16 of the speed reducing mechanism 17. A pump 24, actuated through suitable connections (not shown) from the shaft 16 of the speed reducing mechanism 17, maintains the air within the reservoir 13 at a uniform pressure.

The raw formations released to drop into the cooking liquor as hereinbefore explained, are progressed along the length of the receptacle 5 by a continuously moving conveyor 25 consisting of a pair of laterally-spaced side chains 26 which are trained over sprocket wheels 27 and 28 respectively mounted on cross shafts 29 and 30 at opposite ends of the receptacle 5. As shown in Figs. II and III, the sprocket chains 26 are connected by transverse bars or vanes 31, with provision of a succession of cells at the level of the cooking liquor L in which the individual doughnuts D are maintained in definite separation incident to their progression afloat in the receptacle. Like the forming device 7, the conveyor 25 derives motion from the shaft 16 of the speed reducing mechanism 17, the interposed connections including a horizontal shaft 32, see Fig. I, which at one end carries a miter gear 33 that meshes with a companion miter gear 34 on the shaft 16 of the aforesaid speed reduction mechanism. At its opposite end the horizontal shaft 32 carries a miter gear 35 in mesh with a companion miter gear 36 on a transverse shaft 37 which is coordinated, by means of a sprocket chain 38, with another transverse shaft 39 above the cooking receptacle 5. Through a pair of intermeshing spur gears conventionally indicated at 40 and 41 in Fig. I, motion is communicated from the shaft 39 to the shaft 29 of the conveyor sprockets 27 so that the conveyor 25 is moved at a relatively slow but constant rate of speed. After the doughnuts have been progressed the full length of the receptacle 5, they are discharged from the apparatus by an ejector belt 42 (Fig. I) with side chains trained about sprocket wheels 43 and 44. As shown, the shaft 45 for the sprocket wheels 43 of the ejector belt 42 is driven, through a chain connection 46, from the shaft 29 of the conveyor sprocket wheels 27.

In adapting a cooking apparatus such as briefly described up to this point to the purposes of my present invention, I mount over the top of the receptacle 5 at the feeding end thereof and immediately adjacent the forming device 7, an auxiliary receptacle 50 containing cooking liquor L'. A submerged electric coil 51 in the auxiliary tank 50 is automatically controlled by an adjustable thermostatic regulator conventionally indicated at 52 in Fig. II. As shown, the bottom of the auxiliary receptacle 50 is formed with transverse downward corrugations which are slotted longitudinally as at 53 with formation of nozzles that spray the liquor L' over the doughnuts D during the initial period of the cooking. Liquor corresponding in amount to that discharged into the cooking receptacle 5 from the auxiliary receptacle 50 flows over a vertically-regulatable dam

device 55 into a pocket 56 located at one side of said cooking receptacle, see Figs. II and III. From this pocket 56, the overflow liquor passes, by way of a connecting pipe 57, to a collecting reservoir 58 beneath the cooking receptacle 5. A pump 59 interposed in a connecting pipe line 60, operates to draw the liquor from the collecting reservoir 58 and to discharge it directly into the auxiliary receptacle 50, the said pump being actuated, through a sprocket chain connection 61, from the shaft 16 of the speed reducing mechanism 17, see Fig. I.

For the purpose of periodically turning the doughnuts during cooking, I locate at suitable intervals along the length of the main tank 5 beyond the auxiliary receptacle 50 by which the doughnuts are sprayed during the early stages of the cooking, a number of devices 62 for turning the doughnuts over. As shown in the drawings, there is, in the present instance, one of these devices 62 immediately adjacent the end of the auxiliary tank 50 and two others at uniformly spaced intervals further along the line of progression of the doughnuts D in the tank. These turnover devices are preferably of the type featured in a co-pending patent application, Serial No. 492,402 filed by me on October 31, 1931, consisting in each instance of a rotor with a number of radial fingers 63 which radiate from a shaft 64 extending transversely of the receptacle 5 immediately below the upper run of the conveyor and which are adapted to be engaged successively by the transverse bars or vanes 31 of said conveyor. Each turnover 62 is thus continuously revolved about its shaft 64, the doughnuts being successively lifted as the fingers 63 pass upward between contiguous bars or vanes of the conveyor 25. Upon being elevated to vertical position on edge, the doughnuts D fall forwardly and turn over automatically without transference between adjacent subdivisions or cells of the conveyor—all as described in the application last referred to.

In the use of the apparatus, the thermostatic regulator 52 is set to maintain the liquor L' in the auxiliary receptacle 50 at about 320° F.; or 80° less than that of the liquor in the main cooking tank 5. As the raw annular formations are released by the forming device 7, they drop horizontally into the tank 5, sinking in the liquor L until sufficient gasses are generated in them under the action of the heat, to render them buoyant. After a few seconds of submergence in the liquor L, the doughnuts D rise to the surface and float on one side while being maintained in definite separation between the vanes 31 of the conveyor 25. By said conveyor 25, the doughnuts D are advanced beneath the auxiliary tank 50 and incidentally sprayed with the hot liquor. By action of the spray, the exposed upper sides of the doughnuts D are expanded concurrently with the under sides which are immersed in the liquor. The lower temperature of the spray liquor however insures against too rapid crusting of the exposed upper faces of the doughnuts, so that the moisture may escape readily upward through them with attendant uniform expansion of the dough during the spraying period of the cooking. Immediately after subjection to the spraying action just described, the doughnuts successively encounter the first of the turnovers 62, and, by the latter, are turned over before the surfaces originally immersed in the cooking liquor L have had time to form a crust of a hardness to preclude subsequent release of moisture through them. Incident to progression between the first and the

second of the turnovers 62, the sides of the doughnuts D now immersed in the cooking liquor L are given a further opportunity to expand. This expansion continues until the doughnuts D arrive at the second of the turnover devices 62 whereupon they are again turned over so that their other sides are given a further opportunity to expand. After being turned a third time by the last of the turnovers 62, the doughnuts are progressed by the conveyor 25, to the elevating belt 42 and ejected from the apparatus at the delivery end. By combined spraying and multiple turning as herein set forth, it is obvious that I am able to predetermine gradual expansion and crusting of the doughnuts in such manner as to insure a thoroughly cooked product which is light in texture, evenly browned all over, and which is regular as to size and configuration.

It is to be expressly understood that I do not wish to be limited to the exact type of turn-over devices illustrated by way of example in the drawings, since other types may be substituted with attainment of advantages equal in all respects to those hereinbefore pointed out. I moreover consider it within the province of my invention to vary the number of the turn-overs employed as may be found convenient or desirable in practice, and also to spray the doughnuts throughout the duration of the cooking period instead of part of the time only as hereinbefore specifically described.

Having thus described my invention, I claim:

1. The method of cooking doughnuts and the like by flotation for a time on one of their sides in hot cooking liquor and for a time on their other sides, and concurrently spraying the doughnuts with hot cooking liquor at a temperature somewhat less than that of the liquor in which they float.

2. The method of cooking doughnuts and the like by spraying them with hot cooking liquor while afloat in hot cooking liquor, and periodically turning them over in the liquor without attendant spraying.

3. The method of cooking doughnuts and the like by spraying them for a time with hot cooking liquor while afloat on one of their sides in hot cooking liquor, and subsequently turning them over to float on their opposite sides in the liquor.

4. The method of cooking doughnuts and the like by flotation for a time on one of their sides in hot cooking liquor, and concurrently spraying them with hot cooking liquor at a temperature somewhat less than that of the liquor in which they float, and subsequently turning the doughnuts over to float on their opposite sides in the liquor.

5. The method of cooking doughnuts and the like by spraying them for a time with hot cooking liquor while afloat in hot cooking liquor, and subsequently turning them over periodically in the liquor to complete the cooking.

6. The method of cooking doughnuts and the like by flotation for a time on one side in hot cooking liquor and concurrently spraying them with hot cooking liquor at a temperature somewhat less than that of the liquor in which they float, and subsequently turning the doughnuts over periodically in the liquor to complete the cooking.

7. The method of cooking doughnuts and the like by progressing them afloat in hot cooking liquor, periodically turning them over in the liquor incident to progression so as to float alternately on their opposite sides, and spraying

them, during the early stages of the cooking with hot cooking liquor at a temperature somewhat less than that in which they float.

8. The method of cooking doughnuts and the like by progressing them afloat in hot cooking liquor, periodically turning them over incident to progression in the liquor, and spraying them with hot cooking liquor during the initial stages of the cooking.

9. The method of cooking doughnuts and the like by progressing them afloat in hot cooking liquor while spraying them with hot cooking liquor, and thereafter periodically turning them over incident to further progression in the liquor for completion of the cooking.

10. In apparatus for cooking doughnuts and the like, a receptacle containing hot cooking liquor, means to successively release raw doughnuts into the receptacle, means for progressing the doughnuts in the receptacle in definite succession afloat in the liquor, synchronously operating means to turn the doughnuts over likewise in definite succession so as to float alternately on opposite sides incident to progression in the liquor and means for spraying the doughnuts with hot cooking liquor before the first turning.

11. In apparatus for cooking doughnuts and the like, a receptacle containing cooking liquor, means for maintaining the liquor in the receptacle at a definite cooking temperature, means for progressing the doughnuts in the receptacle afloat in the cooking liquor, an auxiliary receptacle above the cooking receptacle releasing a spray of cooking liquor over the doughnuts, means for automatically maintaining the spray liquor at a temperature somewhat less than that of the liquor in the cooking receptacle, and means for periodically turning the doughnuts over incident to progression as aforesaid.

12. In apparatus for cooking doughnuts and the like, a receptacle containing hot cooking liquor, means for progressing the doughnuts in the receptacle afloat in the liquor, an auxiliary receptacle above the cooking receptacle releasing a spray of cooking liquor over the doughnuts, means for automatically maintaining the liquor in the auxiliary receptacle at a temperature different from that of the liquor in the cooking receptacle, pump means for drawing the spray liquor from the cooking receptacle and conducting it to the auxiliary receptacle, and means for periodically turning the doughnuts over in the liquor incident to progression as aforesaid.

13. In apparatus for cooking doughnuts and the like, a receptacle containing hot cooking liquor, forming means releasing raw doughnuts to drop successively into the cooking receptacle, means for progressing the doughnuts in the receptacle afloat in the cooking liquor, means immediately adjacent the forming means for spraying the doughnuts with hot cooking liquor and means operative after the doughnuts have been progressed beyond the spray means for periodically turning them over to complete the cooking.

14. In apparatus for cooking doughnuts and the like, a receptacle, means for maintaining the liquor at a definite cooking temperature, forming means releasing raw doughnuts to drop successively into the receptacle, means for progressing the doughnuts in the receptacle afloat in the cooking liquor, an auxiliary receptacle immediately adjacent the forming means discharging a spray of the cooking liquor over the doughnuts, means for automatically maintaining the spray liquor in the auxiliary receptacle at a temperature

somewhat less than that of the liquor in the cooking receptacle, and means operative after the doughnuts have been progressed beyond the spray region to periodically turn them over in the cooking liquor during further progression in the apparatus.

15. In apparatus for cooking doughnuts and the like, a receptacle containing hot cooking liq-

uor, means for progressing the doughnuts in the receptacle afloat in the liquor, means for periodically turning over the doughnuts incident to progression as aforesaid, and an auxiliary receptacle above the cooking receptacle releasing a spray of cooking liquor onto the doughnuts before the first turning.

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10	85
15	90
20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
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75	150